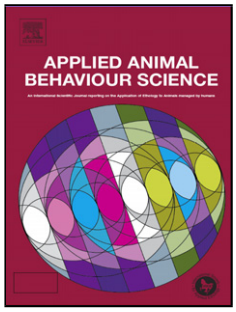

Title: The effects of audiobooks on the behaviour of dogs at a rehoming kennels

Author: Clarissa Brayley V. Tamara Montrose

PII: S0168-1591(15)00312-3
DOI: http://dx.doi.org/doi:10.1016/j.applanim.2015.11.008
Reference: APPLAN 4157

To appear in: *APPLAN*

Received date: 21-5-2015
Revised date: 9-11-2015
Accepted date: 15-11-2015

Please cite this article as: Brayley, C., Montrose, V.T.,The effects of audiobooks on the behaviour of dogs at a rehoming kennels., *Applied Animal Behaviour Science* (2015), http://dx.doi.org/10.1016/j.applanim.2015.11.008

The effects of audiobooks on the behaviour of dogs at a rehoming kennels.

Clarissa Brayley, V. Tamara Montrose*Tamara.montrose@hartpury.ac.uk

Hartpury University Centre, Department of Animal and Land Sciences, Hartpury College, Hartpury, Gloucestershire, United Kingdom GL19 3BE

Tel.: +441452702464, fax: +441452700629

Abstract

Domestic dogs are often kept in kennelled environments. These may be stressful, and impact negatively upon welfare, due to unpredictable variations in space, social interaction and noise. Auditory stimulation such as music has been demonstrated to enhance animal welfare in a range of species, however despite suggested benefits in humans the potential of audiobooks as auditory enrichment for animals has not been investigated. The present study aimed to investigate the effects of audiobooks upon the behaviour of 31 dogs housed in a rescue shelter. The dogs were exposed to five auditory conditions (audiobook, classical music, pop music, psychoacoustically designed dog music and no auditory control) for 2 hours with an intervening period of 2 days between conditions. The dogs' behaviour were recorded every 5 minutes throughout the 2 hour auditory conditions using instantaneous scan-sampling. The findings from the present study indicate that exposure to audiobooks significantly influences the behaviour of kennelled dogs. Audiobooks resulted in dogs spending more of their time resting than when exposed to any of the other auditory conditions (Control: $Z = -4.807$, $P < 0.001$; Pop: $Z = -4.791$, $P < 0.001$; Classical: $Z = -4.732$, $P < 0.001$; Psychoacoustically designed dog music: $Z = -3.911$, $P < 0.001$). Dogs also spent less time displaying sitting or standing vigilant behaviour when the audiobook was played compared to all other conditions (Control: $Z = -4.579$, $P < 0.001$; Pop: $Z = -4.504$, $P < 0.001$; Classical: $Z = -3.450$, $P = 0.001$; Psychoacoustically designed dog music: $Z = -3.514$, $P < 0.001$). This study suggests that exposure to audiobooks can enhance the welfare of kennelled dogs due to their calming influence on dog behaviour. Use of audiobooks provides a simple yet practical tool that can be readily used in many kennel environments to enhance dog welfare and potentially increase the likelihood of successful rehoming of dogs.

Keywords

Audiobooks, Auditory stimulation, Animal Welfare, Dogs, Environmental enrichment.

1. *Introduction*

Audiobooks increase resting behaviour in kennelled dogs.
Audiobooks decrease sitting/standing behaviour in kennelled dogs.
Audiobooks have potential as auditory enrichment for kennelled dogs.

Domestic dogs are kept in kennel environments for a range of reasons with rescue, boarding, quarantine and laboratory kennels being commonplace (Hubrecht, 1995; Taylor and Mills, 2007). Kennels are often stressful environments due to the associated spatial and social restrictions (Beerda et al., 1999a; Hiby et al., 2006; Taylor and Mills, 2007). Limited social interactions, restricted space, high noise levels and lack of control occurring within kennels are all potential sources of stress for dogs (Hubrecht and Turner, 1998; Sales et al., 1997; Taylor and Mills, 2007). Continued exposure to these factors can result in chronic stress and compromised welfare (Beerda et al., 1999ab; Beerda et al., 2000). They can also lead to

behavioural problems (Serpell and Jagoe, 1995; Tuber et al., 1999; Wells and Hepper, 2000) which can impact upon successful re-homing of shelter dogs (Mondelli et al., 2004; Normando et al., 2006).

Auditory stimulation is a form of sensory enrichment that can include sounds of conspecifics, natural habitat sounds and music (Wells, 2009). A number of studies have demonstrated the potential for the use of music to enhance animal welfare. Listening to music can result in physiological and psychological benefits in humans (McCraty et al., 1998; Särkämö and Soto, 2012; Sousou, 1997; Wall and Duffy, 2010). Classical music has also been shown to be beneficial in reducing abnormal behaviour in Asian elephants, *Elephas maximus* (Wells and Irwin, 2008) and gorillas, *Gorilla gorilla* (Wells et al., 2006, But cf, Robbins and Margulis, 2014). Domestic cats have not been found to benefit from musical stimulation (Stephens and Montrose, 2014) however have recently been shown to exhibit a preference for specially designed species-appropriate music (Snowdon et al., 2015). Few studies currently exist into the effects of auditory stimulation on kennelled dogs. Wells et al. (2002) investigated effects of exposure to human conversation, classical, pop and heavy metal music on behaviours of dogs in rescue kennels. They found that exposure to classical music resulted in dogs spending more time resting and less time standing and barking when compared to the other auditory or control conditions. Kogan et al. (2012) furthered this investigation, identifying behavioural changes in kennelled dogs upon exposure to classical, heavy metal and psychoacoustically designed dog music. They found dogs spent more time sleeping and less time vocalising when exposed to classical music than the other auditory treatments. Recently Bowman et al. (2015) found classical music to induce more resting behaviour and less time standing and barking in kennelled dogs compared to a silent control condition. Excessive barking and activity are indicators of stress in dogs (Beerda et al., 2000; Hetts et al., 1992; Stephen and Ledger, 2010). Classical music is seemingly efficacious as environmental enrichment for kennelled dogs, however other forms of potentially beneficial auditory stimulation have not yet been investigated in a kennel environment.

An audiobook is a recording of a book read by the author, an actor, a celebrity or an amateur (Colbjørnsen, 2015). Audiobooks are widely utilised as a form of human entertainment (APA 2014). Audiobooks have been suggested to provide company and comfort to listeners and enable control over the emotional state of their physical environment (Pedersen and Have, 2012). The use of audiobooks has also been found to aid neurological rehabilitation in stroke patients (Särkämö et al. 2010), and to have beneficial emotional effects in dyslexic children (Milani et al., 2010). However, to date, the potential of audiobooks as auditory enrichment for animals, including kennelled dogs, has not been investigated. The present study aimed to investigate the effects of audiobooks upon the behaviour of kennelled dogs. In order to determine how these effects compared to other forms of auditory stimulation we also examined the effects of classical, pop and psychoacoustically designed dog music upon the behaviour of the kennelled dogs.

2. Material and methods

2.1. Subjects

Thirty one dogs (twenty four males; seven females) aged between 9 months and 13 years and 2 months (mean age: 5 years and 4 months) were used in this study. All dogs were neutered or spayed and in good general health including possessing good hearing. The dogs' had varying origins such that eighteen were owner relinquished, five removed from their owners due to welfare concerns and eight were strays. All of the dogs were housed at Burford Blue

Cross rehoming centre, Burford, Oxfordshire, UK. The centre is divided into four blocks each of which has the capacity to house six dogs. Within each block each dog was singly housed in individual kennels. The kennel blocks are not open to the public with only Blue Cross staff and volunteers having access to the kennels. The potential confounding factors of visiting hours and the impact of visitors upon the dogs' behaviour were thus negated. The length of time that the dogs had been housed in the kennels varied from 7 days to 330 days (mean length of time in kennels: 51.4 days). Dogs soon to be rehomed were excluded from data collection ensuring that every dog studied was exposed to all auditory conditions. Kennels were made of concrete with wire doors and were rectangular in shape, varying in size from 3m by 2m to 4m by 4m. All kennels contained a bed, toys, food and water bowls. Kennels were cleaned daily at 8:30 h. Dogs were taken into individual outside runs twice daily for approximately an hour in the morning whilst cleaning occurred and a second hour in the afternoon. Dogs were walked at least once a day. Dogs were fed two or three times daily. The feed times varied depending on the dogs' condition with underweight dogs being fed three times a day. All dogs were fed at 9:30 h and 15:30 h, and underweight dogs were fed again at 12:00 h. Of the thirty-one dogs in the study only seven dogs were fed three times a day. These dogs received the three feeds consistently throughout all conditions in the study.

2.2. Auditory treatments

The dogs experienced five different auditory treatments: audiobook, classical music, pop music, psychoacoustically designed dog music and no auditory control. For the audiobook condition 'The Lion, the Witch and the Wardrobe' (C.S.Lewis; performed by Michael York, Harper Collins publisher) was used. In the classical condition, dogs were exposed to 'The best of Beethoven' album (Naxos). In the pop condition, a randomly chosen mixture of tracks from a pop album 'Now 88' (EMI Virgin Records) were used. In the dog specific music condition, dogs experienced the psychoacoustically designed dog music album "Through a dogs' ear" (Leeds and Wagner, 2008). All auditory treatments were played at 60 decibels, the same volume as normal conversation (NIH, 2011), to ensure that it would not be harmful to dogs or staff. In all auditory conditions dogs were also exposed to normal kennel sounds such as barking and staff talking. The audiobook used was selected as it is popular amongst humans and appropriate for all ages, therefore is suitable for a range of environments (Good Reads, 2015). The other auditory conditions were used to enable comparison of the audiobook treatment with auditory conditions used in previous enrichment studies (e.g. Bowman et al., 2015; Kogan et al., 2012; Wells et al., 2002).

2.3. Procedure

The experimental design used was based on that previously utilised to investigate the effects of auditory stimulation on kennelled dogs (Wells et al., 2002). A CD player (Lenco SD-24, UK) was placed in the central empty kennel of each block, between 4m and 12m away from each individual. Dogs experienced each auditory condition for two hours from 10:00 h to 12:00 h, with an intervening period of two days between treatments to avoid over stimulation. The control condition was applied first followed by pop music, classical music, audiobook, and psychoacoustically designed dog music. This order was randomly determined. The dogs' behaviour was recorded every 5 minutes using an instantaneous scan-sampling technique resulting in twenty-four behaviour points being recorded for every condition. The behaviour of each dogs at each of these points was recorded using an ethogram (based on Hubrecht et al., 1992; Stephen and Ledger, 2005; Wells et al., 2002; Table 1). Video cameras (Vivitar DVR508, UK) set up to view the entirety of each dog kennel were used to record dog

behaviour and avoid observer effects (Martin and Bateson, 2007). The authors have read and can confirm that this study complies with the ISAE policy relating to animal ethics.

2.4. Data Analysis

For each auditory treatment the total number of times each dog was recorded exhibiting each behaviour was summed. A total frequency count for each dog for each behaviour was thus generated. Where behaviours were exhibited at very low levels (mean occurrence <1) they were omitted from analysis as statistical analyses are not robust at such low levels. Otherwise Wilcoxon Signed-Rank Tests were conducted for each behaviour to evaluate differences between audiobooks versus each of the other auditory treatments. The statistical significance level was accepted at $P < 0.05$. All analyses were carried out in SPSS (version 22.0, SPSS Inc. 2013).

3. Results

3.1. Walking

In a comparison of the efficacy of the audiobook and other auditory conditions, significant differences between walking behaviour were found between the audiobook and the control condition ($Z = -3.181$, $P = 0.001$), pop condition ($Z = -3.224$, $P = 0.001$) and psychoacoustically designed dog music condition ($Z = -4.171$, $P < 0.001$). For all these conditions, lower levels of walking behaviour occurred in the audiobook condition (Table 2). No difference in walking behaviour was found between the audiobook and classical music conditions ($Z = -1.198$, $P = 0.231$).

3.2. Sitting/Standing

The levels of sitting/standing behaviour differed between the audiobook and all other auditory conditions (Control: $Z = -4.579$, $P < 0.001$; Pop: $Z = -4.504$, $P < 0.001$; Classical: $Z = -3.450$, $P = 0.001$; Psychoacoustically designed dog music: $Z = -3.514$, $P < 0.001$). For all these comparisons, lower levels of sitting/standing behaviour were displayed in the audiobook condition (Table 2).

3.3. Inactive (resting/sleeping)

Significant differences between inactive behaviour were found between the audiobook and all other auditory conditions (Control: $Z = -4.807$, $P < 0.001$; Pop: $Z = -4.791$, $P < 0.001$; Classical: $Z = -4.732$, $P < 0.001$; Psychoacoustically designed dog music: $Z = -3.911$, $P < 0.001$). Higher levels of resting/sleeping behaviour were displayed in the audiobook condition (Table 2).

3.4. Barking

Barking behaviour differed between the audiobook condition and the pop music condition ($Z = -3.229$, $P = 0.001$), classical condition ($Z = -2.018$, $P = 0.044$), and psychoacoustically designed dog music condition ($Z = -2.832$, $P = 0.005$). For all these comparisons, lower levels of barking were exhibited in the audiobook condition (Table 2). No difference in barking behaviour was found between the audiobook and control condition ($Z = -1.753$, $P = 0.080$).

3.5. Other vocalisations (howling/growling/whining)

The levels of other vocalisations displayed differed between the audiobook and control condition ($Z = -3.639$, $P < 0.001$) and audiobook and pop condition ($Z = -3.519$, $P < 0.001$). Lower levels of vocalisations occurred in the audiobook condition (Table 2). Levels of vocalisations did not significantly differ between the audiobook and classical condition ($Z = -1.157$, $P = 0.247$) or the audiobook and psychoacoustically designed dog music condition ($Z = -0.922$, $P = 0.357$).

3.6. Other Behaviours

All other behaviours were performed at very low levels and were omitted from the statistical analyses.

4. Discussion

The findings from the present study indicate that exposure to audiobooks significantly influences the behaviour of kennelled dogs. Audiobooks resulted in dogs spending more of their time resting or sleeping than any of the other auditory conditions. Dogs also spent less time sitting or standing when exposed to audiobooks compared to all other conditions. Lower levels of barking were also displayed when exposed to audiobooks compared to all other conditions bar the control. Audiobooks also decreased walking behaviour in dogs compared to all auditory treatments bar classical music where in both conditions similarly low levels of walking behaviour were displayed. Lower levels of vocalisations such as howling, growling and whining were displayed in the audiobook condition compared to the control and pop conditions.

A number of these behaviours such as increased activity and vocalising act as indicators of stress in dogs (Beerda et al., 2000; Hetts et al., 1992; Stephen and Ledger, 2000). Sitting and standing behaviour, which tended to be performed by subjects at the front of kennels alongside vigilance behaviours, has also been suggested to be indicative of anxiety or distress (Beerda et al, 2000; Hiby et al., 2006; Taylor and Mills, 2007). Exposure to audiobooks resulted in reduced vocalising and sitting or standing vigilant behaviour as well as increased resting behaviour, all of which are indicative of lower levels of stress in dogs (Beerda et al., 2000; Hetts et al., 1992; Hiby et al., 2006; Stephen and Ledger, 2000). The changes in behaviour induced by audiobooks are therefore suggestive of enhanced welfare in dogs.

Whilst exposure to classical music was equally effective in terms of reducing behaviours such as walking, a finding which is perhaps unsurprising considering the beneficial effects that classical music has been shown to produce in kennelled dogs (e.g. Bowman et al., 2015; Kogan et al., 2012; Wells et al., 2002), exposure to audiobooks was more effective than all other auditory conditions, including classical music, in enhancing resting behaviours. Activity is often used as an indicator of canine stress (e.g. Beerda et al., 2000; Hetts et al., 1992; Stephen and Ledger, 2010), with enhanced resting behaviour being viewed as indicative of relaxation and improved welfare in kennelled dogs (Kogan et al., 2012; Wells et al., 2002). Excessive barking is another indicator of canine stress (e.g. Hetts et al., 1992; Stephen and Ledger, 2010). Whilst lower levels of barking were also displayed under the control condition, the audiobook treatment was the most effective of the auditory stimulation

conditions in reducing barking. This study therefore suggests that audiobooks may be a more beneficial form of auditory enrichment for kennelled dogs than classical music. This result is somewhat surprising considering the enriching effects of classical music that have been documented in a range of species (e.g. Chickens, *Gallus gallus domesticus*: Gvaryahu et al. 1989; Carp, *Cyprinus carpio L*: Papoutsoglou et al., 2007; Gorillas: Wells et al., 2006; Dogs: Wells et al. 2002; Asian Elephants: Wells and Irwin, 2008), however audiobooks have also been demonstrated to benefit humans via providing company, comfort and other positive emotional effects (Milani et al., 2010; Pedersen and Have, 2012). Dogs are highly social animals whose welfare is enhanced by human interactions (Taylor and Mills, 2007; Tuber et al, 1996; Wells, 2004). Audiobooks may approximate this human interaction for dogs and thus provide the illusion of company and comfort in a kennel environment.

These beneficial effects of audiobooks are also interesting considered that a previous study has found that human conversation had no effect on dog behaviour (Wells et al., 2002). This difference could be due to the fact that whilst dogs may habituate to conversation due to this being heard on a regular basis, audiobooks are likely to be a novel form of auditory stimulation due to being rarely played within kennel environments. Another factor to consider is the presentation of audiobooks as opposed to overheard conversation. Audiobooks are characterised by clear and strong enunciation, a steady pace and tempo, and non-monotonous or stilted delivery (NLS, 1995). The focused delivery of the audiobook (Pedersen and Have, 2012) may also make the narration of more relevance to the dog. These aspects may help ensure that the dog retains interest in the audiobooks, as opposed to regular human conversation.

This study indicates that exposure to audiobooks can have beneficial effects on the welfare of dogs in a kennel environment. Kennels are frequently stressful environments due to the restricted space and social interactions and high noise levels (Hubrecht and Turner, 1998; Sales et al., 1997; Taylor and Mills, 2007) so any amelioration of this stress is beneficial for dog wellbeing. It is also important to consider indirect effects on dog welfare. By reducing the stress of kennelled dogs this may not only reduce behaviours such as excessive barking or activity (Serpell and Jagoe, 1995; Stephen and Ledger, 2010), but also potential behavioural problems (Tuber et al., 1999; Wells and Hepper, 2000), both of which can impact upon rehoming potential and successful rehoming of shelter dogs (Mondelli et al., 2004; Normando et al., 2006; Wells and Hepper, 2000).

5. Conclusions

Overall, the findings from this study indicate that audiobooks have beneficial effects upon the behaviour of kennelled dogs. The audiobook condition influenced the dogs' behaviour in a manner suggestive of improved welfare, displaying positive effects upon dog behaviour even compared to classical music, which has previously proven the most efficacious in kennel environments. Due to their calming influence on dog behaviour, audiobooks are suggested to display strong potential for use as auditory enrichment. Audiobooks provide a simple, cost-effective and practical tool that can be readily used in many kennel environments to enhance dog welfare and potentially increase the likelihood of successful rehoming of dogs. Limitations to the current study include the sample size which was relatively small compared to previous studies in the field (e.g. Bowman et al., 2015; Kogan et al., 2012; Wells et al., 2002) and the limited duration of exposure to auditory stimulation. A further limitation is that

the researcher was not blind to the auditory conditions during behavioural analysis providing a potential source of bias. Investigation of the effects of daily exposure to audiobooks over a longer time frame would be useful to determine whether audiobooks are effective at reducing stress experienced by kennelled dogs in the long term. In addition further research should occur to determine what aspects of audiobooks are important in reducing canine stress. Investigating dog behaviours in response to such factors as the narrator's gender, age, accent, voice pitch and speed of narration would be of interest in determining which audiobooks to play to best enhance the welfare of kennelled dogs.

Acknowledgements

The authors wish to thank Sienna Jones and Chris Browne and two anonymous reviewers for their helpful comments.

References

Audio Publishers Association (APA), 2014. Audio Publishers Association Annual Survey of Members 2014. Accessed on 17/05/15: http://www.audiopub.org/PDFs/APASalesSurvey2014.pdf

Beerda, B., Schilder, M. B., Van Hooff, J. A., De Vries, H. W., Mol, J. A., 1999a. Chronic stress in dogs subjected to social and spatial restriction. I. Behavioral responses. *Physiology and Behavior*, 66(2), 233-242.

Beerda, B., Schilder, M. B., Bernadina, W., Van Hooff, J. A., De Vries, H. W., Mol, J. A., 1999b. Chronic stress in dogs subjected to social and spatial restriction. II. Hormonal and immunological responses. *Physiology and Behavior*, 66(2), 243-254.

Beerda, B., Schilder, M. B., Van Hooff, J. A., De Vries, H. W., Mol, J. A. 2000. Behavioural and hormonal indicators of enduring environmental stress in dogs. *Animal Welfare*, 9(1), 49-62.

Bowman, A., Scottish, S., Dowell, F. J., and Evans, N. P., 2015. 'Four Seasons' in an animal rescue centre; classical music reduces environmental stress in kennelled dogs. *Physiology and behavior*, 143, 70-82.

Colbjørnsen, T. (2015). The accidental avant-garde: Audiobook technologies and publishing strategies from cassette tapes to online streaming services. *Northern Lights: Film & Media Studies Yearbook*, 13(1), 83-103.

Good Reads, 2015. *The Best of the chronicles of Narnia.* Accessed on 18/05/15. Available from: http://www.goodreads.com/list/show/2236.The_Best_of_the_Chronicles_of_Narnia

Gvaryahu, G., Cunningham, D. L., Van Tienhoven, A., 1989. Filial imprinting, environmental enrichment, and music application effects on behavior and performance of meat strain chicks. *Poultry Science*, 68(2), 211-217.

Hetts, S., Clark, J. D., Calpin, J. P., Arnold, C. E., Mateo, J. M., 1992. Influence of housing conditions on beagle behaviour. *Applied Animal Behaviour Science*, 34(1), 137-155.

Hiby, E. F., Rooney, N. J., Bradshaw, J. W., 2006. Behavioural and physiological responses of dogs entering re-homing kennels. *Physiology and behavior*, 89(3), 385-391.

Hubrecht, R.C., 1995. The welfare of dogs in human care. In: Serpell, J. (Ed.), The Domestic Dog. Cambridge University Press, Cambridge, pp. 180–198.

Hubrecht, R. C., Serpell, J. A., Poole, T. B., 1992. Correlates of pen size and housing conditions on the behavior of kenneled dogs. *Applied Animal Behavior Science*, 34, 365–383.

Hubrecht, R.H., Turner, D.C., 1998. Companion animal welfare in private and institutional settings. In: Turner, D., Wilson, C.C. (Eds.), Companion Animal in Human Health. Sage Publications, Thousand Oaks, CA, pp. 267-289.

Kogan, L. R., Schoenfeld-Tacher, R., Simon, A. A., 2012. Behavioral effects of auditory stimulation on kenneled dogs. *Journal of Veterinary Behavior: Clinical Applications and Research*, 7(5), 268-275.

Leeds, J., Wagner, S., 2008. Through a dog's ear: using sound to improve the health and behavior of your canine companion. Sounds True, Boulder, CO.

Martin, P., Bateson, P., 2007. Measuring Behaviour. Cambridge University Press, Cambridge.

McCraty, R., Barrios-Choplin, B., Atkinson, M., Tomasino, D., 1998. The effects of different types of music on mood, tension, and mental clarity. *Alternative therapies in health and medicine*, 4(1), 75-84.

Milani, A., Lorusso, M. L., Molteni, M., 2010. The effects of audiobooks on the psychosocial adjustment of pre□adolescents and adolescents with dyslexia. *Dyslexia*, *16*(1), 87-97.

Mondelli, F., Prato Previde, E., Verga, M., Levi, D., Magistrelli, S., Valsecchi, P., 2004. The bond that never developed: adoption and relinquishment of dogs in a rescue shelter. *Journal of Applied Animal Welfare Science*, 7(4), 253-266.

National Institute of Health (NIH), 2011. How Loud Is Too Loud? Accessed on 18/05/15. Available at: http://www.nidcd.nih.gov/health/hearing/pages/ruler.aspx

National Library Service for the Blind and Physically Handicapped (NLS), 1995. The Art and Science of Audio Book Production. Accessed on 18/05/15. Available at: http://www.loc.gov/nls/other/audioart/allinone.html

Normando, S., Stefanini, C., Meers, L., Adamelli, S., Coultis, D., Bono, G., 2006. Some factors influencing adoption of sheltered dogs. *Anthrozoos: A Multidisciplinary Journal of the Interactions of People and Animals*, 19(3), 211-224.

Papoutsoglou, S.E., Karakatsouli, N., Louizos, E., Chadio, S., Kalogiannis, D., Dalla, C., Polissidis, A., Papadopoulou-Daifoti, Z., 2007. Effect of Mozart's music (Romanze-Andante of ''Eine Kleine Nacht Musik'', sol major, K525) stimulus on common carp (Cyprinus carpio L.) physiology under different light conditions. *Aquacultural engineering*, 36(1), 61-72

Pedersen, B. S., Have, I., 2012. Conceptualising the audiobook experience. *Sound Effects*, 2(2), 79-95.

Robbins, L., Margulis, S.W., 2014. The effects of auditory enrichment on Gorillas. *Zoo Biology*, 33(3), 197-203.

Sales, G., Hubrecht, R., Peyvandi, A., Milligan, S., Shield, B. 1997. Noise in dog kennelling: is barking a welfare problem for dogs?. *Applied Animal Behaviour Science*, 52(3), 321-329.

Särkämö, T., Pihko, E., Laitinen, S., Forsblom, A., Soinila, S., Mikkonen, M., ... Tervaniemi, M., 2010. Music and speech listening enhance the recovery of early sensory processing after stroke. *Journal of Cognitive Neuroscience*, 22(12), 2716-2727.

Särkämö, T., Soto, D. 2012. Music listening after stroke: beneficial effects and potential neural mechanisms. *Annals of the New York Academy of Sciences*, 1252(1), 266-281.

Serpell, J., Jagoe, J. A. 1995. Early experience and the development of behaviour. In: Serpell, J.A. (Ed.), The Domestic Dog: Its Evolution, Behaviour and Interactions with People, Cambridge University Press, Cambridge, pp. 79–102

Snowdon, C. T., Teie, D., Savage, M., 2015. Cats prefer species-appropriate music. *Applied Animal Behaviour Science*, 166, 106-111.

Sousou, S. D., 1997. Effects of melody and lyrics on mood and memory. *Perceptual and motor skills*, 85(1), 31-40.

Stephen, J.M; Ledger, R.A., 2005. An audit of behavioural indicators of poor welfare in kennelled dogs in the United Kingdom. *Journal of Applied Animal Welfare Science*, 2, 79-95

Stephens, G., Montrose, V.T. 2014. Soothing the Savage Beast: The Effect of Auditory Enrichment on Domestic Cats. *The Shape of Enrichment*, 23 (1-2), 9.

Taylor, K. D., Mills, D. S., 2007. The effect of the kennel environment on canine welfare: a critical review of experimental studies. *Animal welfare*, 16(4), 435-447.

Tuber, D. S., Miller, D. D., Caris, K. A., Halter, R., Linden, F., Hennessy, M. B., 1999. Dogs in animal shelters: Problems, suggestions, and needed expertise. *Psychological Science*, 10(5), 379-386.

Wall, M., Duffy, A. 2010. The effects of music therapy for older people with dementia. *British Journal of Nursing*, 19(2), 108-113.

Wells, D. L., 2004. A review of environmental enrichment for kennelled dogs, *Canis familiaris*. *Applied Animal Behaviour Science*, 85(3), 307-317.

Wells, D. L., 2009. Sensory stimulation as environmental enrichment for captive animals: a review. *Applied Animal Behaviour Science*, 118(1), 1-11.

Wells, D. L., Coleman, D., Challis, M. G., 2006. A note on the effect of auditory stimulation on the behaviour and welfare of zoo-housed gorillas. *Applied Animal Behaviour Science*, 100(3), 327-332.

Wells, D. L., Graham, L., Hepper, P. G., 2002. The influence of auditory stimulation on the behaviour of dogs housed in a rescue shelter. *Animal Welfare*, 11(4), 385-393.

Wells, D. L., Hepper, P. G., 2000. Prevalence of behaviour problems reported by owners of dogs purchased from an animal rescue shelter. *Applied animal behaviour science*, 69(1), 55-65.

Wells, D. L., Irwin, R. M., 2008. Auditory stimulation as enrichment for zoo-housed Asian elephants (*Elephas maximus*). *Animal Welfare*, 17, 335–340.

Table 1 Description of dog behaviours sampled.

Behaviour	Definition
Walking	Dog engages in ambulatory gait around kennel.
Sitting/Standing	Dog sits on hind legs/Dog stands on four legs.
Inactive (resting/sleeping)	Dog reclines in ventral or lateral position, eyes open or closed.
Barking	Staccato vocalisation; varying in duration.
Other vocalisations	Includes howling, growling or whining.
Playing	Dog engages in solitary playing with toys; or displays play bow.
Panting	Dog pants for reasons other than physical exertion or a warm ambient temperature.
Drinking	Dog ingests water.
Eating	Dog ingests food.
Repetitive pacing	Dog repeatedly paces around kennel in a fixed route.
Wall bouncing	Dog repeatedly jumps up kennel wall from side to side.
Circling	Dog walks around in small circle repeatedly.
Self-mutilation	Dog chews or bites own body.
Chewing bedding	Dog chews its own bedding.
Digging	Dog digs into the corner of kennel or in bedding with forepaws.

Table 2 The mean (±S.D.) number of times each behaviour was displayed by the dogs in the five auditory conditions.

Behaviour	Control	Classical	Pop	Dog music	Audiobook

Walking	2.97	1.97	2.84	3.10	1.74
	(2.105)	(1.560)	(2.115)	(1.399)	(1.437)
Sitting/ Standing	12.03	10.00	13.68	10.45 (4.523)	8.19
	(5.930)	(4.967)	(5.659)		(4.963)
Inactive	9.61	11.16	7.71	10.35	15.00
	(7.753)	(6.293)	(6.394)	(5.625)	(8.095)
Barking	5.06	4.84	5.90	5.23	3.90
	(0.359)	(5.080)	(5.160)	(5.371)	(4.134)
Other vocalisations	4.10	1.81	2.71	1.84	1.52
	(5.455)	(4.199)	(4.762)	(4.591)	(3.345)
Playing	0.29	0.19	0.13	0.19	0.23
	(0.739)	(0.654)	(0.428)	(0.543)	(0.669)
Panting	0.23	0.16	0.19	0.16	0.16
	(0.956)	(0.735)	(0.792)	(0.735)	(0.735)

Drinking	0.03	0.13	0.06	0.06	0.06
	(0.180)	(0.428)	(0.250)	(0.250)	(0.250)
Eating	0.03	0.03	0.00	0.06	0.13
	(0.180)	(0.180)	(0.000)	(0.250)	(0.341)
Repetitive Pacing	0.84	0.29	0.52	0.58	0.23
	(1.675)	(1.039)	(1.092)	(1.311)	(0.956)
Wall Bouncing	0.45	0.10	0.35	0.13	0.00
	(1.060)	(0.396)	(0.755)	(0.428)	(0.000)
Circling	0.39	0.00	0.13	0.03	0.00
	(1.086)	(0.000)	(0.499)	(0.180)	(0.000)
Chewing Bedding	0.26	0.26	0.10	0.13	0.13
	(0.815)	(0.815)	(0.396)	(0.428)	(0.562)
Digging	0.10	0.06	0.00	0.00	0.00
	(0.539)	(0.359)	(0.000)	(0.000)	(0.000)

511

512
513
514
515
516